

Original Article

Diagnostic accuracy of computed tomography scoring index in predicting mortality among suspected patients of acute pancreatitis.

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Abstract

Background: Acute pancreatitis (AP) is challenging, varying from subtle edema to parenchymal necrosis in severity. Several clinical and radiological scoring criteria have been formulated over the years to predict the disease intensity of AP to guide monitoring and intervention. This study aimed to establish the diagnostic accuracy of high Balthazar's computed tomography scoring index (CTSI) in predicting outcomes in terms of mortality and morbidity among suspected cases of the acutely inflamed pancreas.

Methodology: A cross-sectional study was carried out at the Radiology Department of Jinnah Postgraduate Medical Center (JPMC), Karachi. A total of 1434 clinically suspected AP patients were included in this study. The initial diagnosis was made through contrast-enhanced computed tomography (CECT) of the abdomen. Balthazar's CTSI ascertained the disease severity, and outcomes were recorded in terms of survival and death.

Results: The gender distribution showed a male majority, i.e. 789(55%), and most patients were in the 45-55 year age group comprising 650 patients (45.3%). Moreover, out of 1434 patients, 397(28%) died while the rest survived. This study showed that high CTSI is a prognostic indicator of mortality in suspected cases of AP. It has a sensitivity of 91.9%, specificity of 88.72%, a positive predictive value (PPV) of 94.5% and a negative predictive value (NPV) of 83.98%. Overall diagnostic accuracy (DA) was found to be 90.9%.

Conclusion: It is concluded from the study results that Balthazar's CT severity index is reliable in establishing severity and disease outcome in AP. Thus, its routine application should be encouraged for timely detection and appropriate management of AP.

Keywords

Acute Pancreatitis, Balthazar's Score, Computed Tomography, CT-Severity Index.



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Introduction

Acute pancreatitis (AP) is an unpredictable disease; its prognosis depends upon developing super-added infections of the pancreas or peripancreatic necrosis with possible organ failure. Despite the modern treatment advances, severe acute pancreatitis (SAP) appears to be a relentless disease requiring timely intensive management to reduce mortality rates¹. The commonest etiologies for AP are gallstones, alcohol, hypertriglyceridemia, followed by hypercalcemia, drugs, autoimmune and endoscopic procedures, etc².

The prevalence of AP is 0.08%, with mortality rates between 2.1% and 9.2% worldwide^{3,4}. SAP, also called necrotizing pancreatitis, ensues in 20% of patients, displaying CT scan appearances of tissue necrosis recorded as the absence of pancreatic enhancement, which is associated with increased morbidity and mortality². Patient management in SAP can delay if standard means to evaluate the disease severity in the early stages are not available⁵.

AP is diagnosed by a triad of clinical manifestations, laboratory examinations and radiological imaging. Initial disease severity assessment remains challenging for clinicians even today, and reliability upon various scoring methods still remains quite uncertain⁶. This is where computed tomography (CT) comes into play as the modality of choice⁷. It detects early complications like inflamed peripancreatic planes with retroperitoneal fluid collections during the patient's initial hospital stay. Long-term follow-up imaging of these patients on an outpatient basis might be required to exclude late complications of SAP, including disconnected duct syndrome and pancreatico-cutaneous fistula formation⁸.

CT scan has proved quite helpful in predicting overall outcomes of SAP in early stages⁹. Multidetector CT (MDCT) is mandatory to perform a contrast CT of pancreas⁴, allowing acquisition of thin slices with higher image resolution in a short time with improved details of parenchymal, arterial, and portal venous enhancement¹⁰. Over these last two decades, various radiological prognostic

scoring systems have been proposed¹¹. In 1990, Balthazar et al. proposed a scoring system to evaluate the disease severity of AP¹². CTSI is the finest example of a grading system that predicts outcomes in AP. It was introduced considering the combined imaging assessment of the pancreas and its surrounding soft tissue planes for fluid collections and to evaluate the severity of necrosis of pancreatic parenchyma for obtaining prognostic accuracy¹³. It is comparatively superior to other grading criteria, identifying not only outcomes in AP but also stage disease severity by determining loco-regional complications^{14,15}. This study aimed to ascertain the diagnostic accuracy of high CTSI in predicting outcomes in acute pancreatitis and establish its utility in differentiating mild, moderate and severe AP grades.

Methodology

A cross-sectional study was conducted at the Radiology Department of Jinnah Postgraduate Medical Center (JPMC) in Karachi. The study continued for one year after approval from the institutional ethical review committee. The total number of patients who participated in the study was 1434. Patients were selected by non-probability consecutive technique, and written informed consent was obtained before the inclusion.

We included suspicious cases between 18 to 70 years age range who presented with severe epigastric pain of 3 days with elevated serum amylase levels to 4 times the normal limit. The presence of any two of the following was considered a suspicious case of the acutely inflamed pancreas. (a) Acute onset of severe epigastric pain often radiating to the back along with raised pancreatic serum amylase and lipase thrice to the upper normal limit. (b) Radiological appearances on ultrasonography (US) and CT.

CT scan abdomen after intravenous contrast administration on pancreatic protocol performed within 72 hours of symptom onset using Toshiba Aquilion slice MDCT scanner. Axial images of the abdomen were acquired with sagittal and coronal reconstructions. CTSI was obtained by an

aggregate of Balthazar points. The Balthazar score is considered Grade A (0 points) for normal CT, Grade B (1 point) for focal or generalized pancreatic swelling, Grade C (2 points) for peri-pancreatic inflammation or pancreatic pathology, Grade D (3 points) for single fluid collection, and Grade E (4 points) for two or more fluid collections or nearby air specks. For parenchymal necrosis, CECT images were scored as follows: 2 points if the area of necrosis less than equal to the pancreatic head in size (< 30%), 4 points for 30-50% parenchymal necrosis, and 6 points for more than 50% of glandular necrosis. Furthermore, the scoring of necrosis was 0 if the pattern of parenchymal enhancement was uniform. Imaging findings were documented along with age, gender, duration of symptoms and serum amylase levels in a pre-drafted Performa.

SPSS version 20.0 was used for data analysis. The data was presented using frequencies and percentages. True positive (TP), false positive (FP),

true negative (TN), false negative (FN), sensitivity, specificity and diagnostic accuracy (DA) were calculated. Stratification for age, gender and duration of epigastric pain were done, and a post-stratification chi-square test was applied where $p \leq 0.05$ was considered statistically significant.

Results

Total 1434 suspected AP patients had CT abdomen. All of them had a duration of symptoms of not more than 4 days. The overall age range recorded was 18 to 71 years with a mean age of 44.11 ± 14.36 years. It was observed that the majority of patients were males, 789(55%).

The sensitivity analysis displayed that the CTSI score is 91.9% sensitive in predicting mortality among suspected AP cases. Furthermore, the specificity, positive predictive value (PPV), negative predictive value (NPV) and DA of the used scoring system were 88.72%, 94.5%, 83.98% and 90.9%.

Table 1: Sensitivity, specificity and diagnostic accuracy of CTSI for detection in predicting outcomes in acute pancreatitis

	Sensitivity	Specificity	PPV	NPV	DA
CTSI	91.90%	88.72%	94.50%	83.98%	90.90%

CTSI-Computed Tomography Scoring Index; PPV-Positive Predictive Value; NPV-Negative Predictive Value; DA-Diagnostic Accuracy

Stratification was done with respect to age, gender and epigastric pain duration to see the effect of these characteristics on the CTSI score. It was found that age, gender and epigastric pain duration were significantly associated with the predictive outcomes of CTSI among AP patients ($p < 0.01$).

Table 2: Comparison of CTSI score with patient characteristics.

Characteristics	CTSI \geq 5	CTSI \leq 5	Total	p-value	
Age	< 45 years	165	35	200	<0.01*
	> 45 years	158	39	197	
Gender	Male	323	74	397	<0.01*
	Female	186	58	244	
Epigastric Pain Duration	> 3 Days	180	38	218	<0.01*
	< 3 Days	143	54	197	

Values are given in frequencies. * $p < 0.05$ was considered significant.

Discussion

Appropriate AP diagnosis with timely identification and management of this necrotizing disease is mandatory for attaining improved patient outcomes and reducing the overall hospital stay. Clinically, AP might not be initially identified; it is suggested that nearly 50% of the patients experience delayed or incorrect diagnoses. For this purpose, different scoring criteria combining clinical and laboratory parameters have been designed.

The earliest such system was proposed by Ranson et al. in 1974; it is based on 11 objective signs, which should be recorded in the initial 48 hours of observation¹⁶. Five determinants are observed on admission, and six after 48 hours. Patients with less than three signs do not display any mortality, while patients presenting with six or more signs show that mortality rates rise by 50%, as evidenced by gross pancreatic necrosis. While Balthazar's CTSI is another instrumental grading system that collectively outlines CT findings to predict outcomes of AP. Patients with a CTSI up to 1 are considered to have negligible mortality and morbidity rates, while patients with a score of 2-3 represent a mortality rate of 3% with an 8% morbidity rate. In the case of scores higher than 7, the mortality rate is around 17%, with a 92% morbidity rate¹⁷⁻¹⁹.

The sensitivity, specificity, PPV, NPV and DA of the CTSI scoring system was 91.9%, 88.72%, 94.5%, 83.98% and 90.9%, respectively. A similar study including 211 children was conducted to ascertain the predictive value of CTSI³. This study revealed the superiority of CTSI to the clinical scoring system, as it was found that sensitivity, specificity, PPV and NPV of the CTSI were 81%, 76%, 62%, and 90%, respectively. Another study by Papachristou et al. compared various scoring systems for predicting severity and death among AP cases. It was found that sensitivity, specificity, PPV and NPV of CTSI for severity were 85.7%, 71%, 50.8% and 93.4%, respectively, and for mortality, these were 100%, 58.5%, 8.5% and 100%, respectively²⁰.

Not many studies assessing the diagnostic value of CTSI have been carried out in this part of the world.

Additionally, no comparison has been made between radiological scoring systems and clinical manifestations. While keeping in view the significance of the investigative techniques and the seriousness of the disease, our goal was to establish the diagnostic accuracy of high CTSI in predicting the mortality in suspected cases of AP. But certain limitations need to be addressed, firstly the study was the single center, and we did not attempt to compare the predictive outcomes with any other scoring system.

Conclusion

The present study revealed the high CTSI is effective in predicting mortality and overall outcomes among affected or suspected patients of acute pancreatitis. It is indeed a reliable indicator of prognosis in AP as indicated by the sensitivity, specificity and diagnostic accuracy determined in the study. Thus the routine application of Balthazar's CTSI should be encouraged for timely detection and appropriate management of acute pancreatitis.

Conflicts of Interest

The authors have declared that no competing interests exist.

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